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MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY

XLIX. AN EXPERIMENTAL STUDY OF CUTANEOUS IMAGERY

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By CATHERINE BRADDOCK

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Very little experimental work has been done upon cutaneous imagery, and that little has no more than a preliminary value. The present study was undertaken to find out (*a*) if cutaneous images of pressure, warmth and cold occur, and in that event (*b*) if the images are free or tied, that is, if they are capable of sustaining by themselves alone the whole meaning of a past perception, or if they appear only in the train of other images (visual, auditory, kinaesthetic) which have proved to be thus capable. The outcome is so surprisingly negative that it, too must be regarded as only provisional. We have some good observers, but only a rough method.

*Experiments: Series I*

Our object in a first series of experiments was to obtain a direct comparison of sensory with its corresponding imaginal experience. The sensory stimuli were areal (2 by 1 cm.); metal blocks, rounded at the corners, for warmth and cold; wood covered by felt for pressure. We used two markedly different degrees (weak and strong) of the three qualities. For weak cold the metal block was cooled in water of 10° C, for strong cold in ice-water; for weak warmth the stimulus was heated in water of 4° C, and for strong warmth in water of 10° C, above the temperature of the skin. The cutaneous surfaces investigated were those of forearm, upper arm, forehead and cheek. *O* sat with closed eyes, and the stimulus was set down for 1 sec. Chance determined the order in which the six stimuli should be given. The instruction, in the sensory series, ran: "I shall stimulate the skin [of your forearm, etc.]. When the stimulus is removed, describe the cutaneous experience as well as you can." We thought that the reports of this sensory series might help in *O*'s training, as showing him what to look for in the image; we thought also that, if there should be differences between image and sensation, the differences would stand out the more clearly for the immediately previous experience of sensation. We realised that our heavy pressure stimulated deeper-lying organs, and that our temperature stimuli aroused pressure as well as cold and warmth. It seemed best, in a first attempt, to take these complications into the bargain.

At the conclusion of the sensory series on a given surface there was a pause of 5 min., and an imaginal series began. The instruction ran: "I want you now to think of one of the sensory experiences of the last series. When I have named it, realise it as fully as you can, and then describe it. Think of [strong cold, etc.]." Chance again determined the order.

In general it was found unnecessary to present a sensory series for the various surfaces more than once. Three imaginal series were performed for the four surfaces, so that there were 12 series in all. As these continued two pressures, two warm pressures, and two cold pressures there were possible 72 pressure-images, 24 cold-images and 24 warmth-images.

### *Series II*

In a second series we asked *O* to realise familiar situations in which an image of pressure, cold or warmth might be expected to appear. It seemed possible that, under these conditions, images might be aroused with greater ease. The instruction ran: "Realise the following situation imaginally, and describe it as well as you can, paying particular attention to [cutaneous pressure, etc.]. Think of yourself as"—and then a situation would be given. There were ten situations for the three kinds of experience. We used for cold: stepping into a cold bath, having a snowflake fall on the face, holding a snowball in the hand, feeling a key slip down the back, stepping out of a warm house on a frosty day, laying a finger on a cold radiator, taking too large a spoonful of ice cream, waking up at night to find the bedclothes slipped down, having an icepack on the forehead, feeling a dog's nose against the palm. For warmth: bending over an open fire, stepping into a hot bath, putting the hand in the oven, taking a pot off the range, sipping warm cocoa, stirring a pan of boiling sugar, laying the finger on a warm radiator, clasping the hand round an electric bulb, touching a hot-water bottle with the foot, having a pad of cotton wool bound over the back of the hand. For pressure we tried to find situations which should, so far as possible, rule out kinaesthesia: the feeling of a leaf falling on the back of the hand, the feel of fur against the skin, the feel of an insect on the neck, lying on a stone, the touch of a hand on the shoulder, the feel of the wind beating on the face on a gusty day, a hair-shampoo, being brushed down by a porter, receiving a handful of change from a conductor, the flutter of a moth on the arm.

### *Observers*

There were five *O*'s: Dr. L. B. Hoisington (H), instructor in psychology; Dr. H. G. Bishop (B), assistant in psychology; Mrs. A. K. Whitchurch (W) and Miss C. Braddock (Br), graduate students; and X, an untrained *O*. H and B had recently had extended training in the observation of kinaesthetic imagery.

### GENERAL RESULTS

(1) We cannot say positively, in the light of our results, whether images of cutaneous pressure, warmth and cold occur. If they exist, their appearance seems at best to be rare; and they are so interwoven with sensory experiences (changes in temperature and tension of the skin, kinaesthesia) and with visual and other images that they are very difficult to detect. The *O*'s differed greatly in their reports. W and B, in the majority of cases, were unable to obtain anything but very doubtful images; X, on the other hand, reported their occurrence readily. H and Br were also doubtful in a large proportion of their reports, but obtained at times what seemed like clear cases of

imagery. There may very well be individual differences. But there is no doubt that, in the experience of realising imaginally the former perception of stimulus or situation, meaning may be mistaken for process. Time and again H (our most practised *O*) would report that a former experience of pressure, warmth or cold had been adequately realised, and yet that he could not say whether an imaginal process in kind, a quality of pressure, warmth or cold, was present in the imaginal complex. H also frequently reported a tendency to say that he had obtained an image; he might even set himself to describe it; and then he would realise that some other image had carried the meaning of the cutaneous experience, and had thus suggested that the required qualitative image must be there. Br reported the same sort of thing.

W's and B's doubtful cases were largely of a different order. Many of them were reported as probably sensory and not imaginal, the sort of pressures and temperatures sensed when one attends keenly to a given part of the skin. Both *O*'s, however, and W in particular, reported cases like those of H and Br.<sup>1</sup>

(2) If cutaneous images occur, there is little doubt that they are tied and not free. Practically all the cases in which images appeared as free are cases in which the *O* reported a doubt whether his cutaneous experience was sensory or imaginal. Those cases, on the other hand, which approached nearest to true imagery (though we cannot vouch certainly even for them) were invariably tied either to visual or to kinaesthetic imagery.

#### RESULTS IN DETAIL

*Pressure.*—The reports of the *O*'s differ very greatly. H was more sure of his pressure-images than of the other two kinds. He and X found the images easy to get, and rarely failed to report them. W and B, on the other hand, were in most instances doubtful. Br in Series I regularly reported pressure-images, but became more and more doubtful of them in Series II; deep pressures (kinaesthetic) seemed to be involved. W and B often reported kinaesthesia, which appeared to serve as a substitute for cutaneous pressure.

All of H's reports in Series I contained pressure-images, many of them more than one. The reports began typically with a pressure-image, limited in extent and of brief duration, followed by visual imagery ("bit of lighter grey against a darker grey background") and eye-kinaesthesia, which together served to localise the pressure at the required spot upon the skin. "An experience realised in pressure-terms alone," H remarked at the end of the series, "is a generalised kind of thing, without concrete setting, whereas when the visual image is present it makes the experience definite and particular." The

<sup>1</sup> It is plain that results like those of G. H. Betts (*The Distribution and Functions of Mental Imagery*, 1909, 45 f.) must be taken with many grains of salt. Nor is it of any use to improve one's questionnaire; the fault lies, not with the questionnaire, but with those who are called upon to answer its questions. X, our untrained *O*, gives consistently positive results (in full agreement with those of Betts), and yet it is certain that, whether or not imaginal processes were present, he was reporting meanings and not processes. We must in fairness add that much water has flowed under the bridges since 1909, and that Betts would hardly write to-day as confidently as he wrote a dozen years ago.

pressure-image usually recurred after the localising and particularising had taken place. Sometimes visual imagery or eye-kinaesthesia or auditory-motor processes might occur before the pressure-image appeared, and sometimes the visual and pressure images alternated several times before H was satisfied that his realisation was adequate.

Here, then, there seems to be a clear-cut case of tied pressure-imagery, with visual imagery and eye-kinaesthesia serving as support. We noticed, however, at the beginning of Series II, that H did not (apparently) distinguish between pressure and kinaesthetic imagery; pressure was often reported as "meaning movement."<sup>2</sup> Since the other *O*'s frequently reported kinaesthesia as such, we thought the point worthy of further experiment. We therefore performed short sensory and imaginal series on subcutaneous pressures (etherised skin) and the sensations involved in raising the arm. In the imaginal series the deep pressures became 'surfacy,' bidimensional, though they were not necessarily localised at the surface of the skin. The results appear to show that, at any rate under these rough conditions, there is for H no difference, in process-terms, between subcutaneous and cutaneous pressure.

If this interpretation is correct, H's reports square very well with those of Br. Here the typical report is that of a visual image representing the stimulus, followed by a deep pressure, referred by the *O* to kinaesthesia. In the effort after full realisation of the perceptive experience these images alternated, the pressure coming nearer and nearer to the surface, until finally it appeared as a flash-like process on the skin itself. The visual image of the stimulus was necessary to *O*'s realisation of the corresponding perception. The flash-like pressures were (as has been said) at first accepted as cutaneous; later on the *O* became very doubtful of their validity.

B, on the other hand, reported typically pressures of large area and long duration, which seemed to be sensory in nature, and to resemble the pressures brought out by sustained attention to the skin. It is possible, however, that kinaesthetic imagery was involved; since, after a supplementary series on deep-seated pressures (similar to that taken with H), B remarked that all the pressures of Series I and II had extended a little below the surface of the skin. Kinaesthesia itself was often reported. B was reluctant, throughout the experiment, to commit himself to an imaginal report.<sup>3</sup>

W relied for realisation of her perceptive experiences mainly on visual imagery. She also reported a great deal of kinaesthesia. Her usual 'cutaneous images' were of the same sensory nature as B's. She remarked in both series that if there were no visual image there would certainly be no cutaneous; and in Series II she reported no cutaneous image that was not possibly sensory.

We thus have three possibilities as regards the image of cutaneous pressure.

(1) True images exist, but occur only as bound up with visual or kinaesthetic images. Evidence for this view may be found in the reports of H and X (visual support), and in many of the reports

<sup>2</sup> In the situation of stepping into a cold bath, movement in the leg and shiver in the back were gross enough to be noticed by *E*, although H reported pressure only.

<sup>3</sup> We have tried to tabulate the reports, but have found the task impossible. The *O*'s 'hedge' and qualify from the start, and grow more and more doubtful as the experiment proceeds.

of Br (kinaesthetic support), and in a few reports of W (visual support).

(2) Deep-pressure images are mistaken for images of cutaneous pressure. This view accords best with Br's results, and in part with those of B. The meanings of skin-surface, localisation, and extension, are carried in visual terms.

(3) Sensory kinaesthesia is mistaken for imaginal cutaneous pressure, and together with visual imagery carries the meaning of skin-surface, localisation, extension. Evidence for this view may be found in the reports of X, W and B; to some extent also in those of Br.

It is possible to read H's results in the sense of (2) and (3), especially since we know that H was set to report qualities, and (as he told us later) avoided the term 'kinaesthetic' owing to its merely functional meaning. As Br and W became increasingly doubtful with practice, and as X's reports may be discounted, the evidence for (1) is very slender. We have no doubt, on the other hand, that (2) and (3) cover part of the facts; the only question is whether they are adequate to the whole.

*Warmth and Cold.*—All the O's except X were uncertain of these images; every report has some measure of doubt attaching to it. H and W were less sure of cold than of warmth, Br was less sure of warmth than of cold. The reports fall into four more or less distinct groups: (a) a deep intense warmth or cold with something pricking or stinging about it; (b) a diffuse experience, like a breath of warm or cold air sweeping over a largeish area of the skin (fair intensity, long duration), which runs into sensory warmths or colds elsewhere in the body; (c) an experience like a puff of warm or cold air, small in extent, very weak in intensity, short in duration; and (d) an experience of pressure, with warmth or cold inherent in it. In the case of warmth there was a variant of (b), in which the warmth began in a small area and spread gradually in waves till it merged with the bodily warmth elsewhere.

The experience reported in (a) occurs but rarely (H, Br, W). It seems to be kinaesthetic in nature. Experience (b) is often reported by all O's, and is typical for B. It seems to be obviously sensory; indeed, the qualification "perhaps sensory" is appended to many of the reports. The variant is also probably sensory, at least in some measure. It occurred typically in X's reports, always bound up with visual or pressure imagery.

There remain (c) and (d), in which if anywhere we shall find true images of warmth and cold. The experiences of (c) were extremely vague and elusive, "just a flash and then gone," so that the O's found description almost impossible. Since the stimuli of Series I combined temperature with pressure, there was greater variety under (d): pressure might appear without warmth or cold, pressure might immediately precede or follow warmth or cold, pressure and warmth or cold might occur together, at roughly the same intensity and clearness, or pressure might be predominant, with a tinge of warmth or cold added to it. H and Br report all these modes of experience, though with the recurring doubt of the imaginal character of warmth and cold; W and B were too much in doubt to do more than report a possible temperature as given with the visual image or the pressure.

Visual images were important for all O's except B, and were indispensable to W. In the latter part of Series I, H and Br tended to drop vision for pressure (kinaesthesia?), but the visual images were

prominent again in Series II. If temperature images occurred, they were certainly tied, either to vision or to pressure. We did not experiment with radiant heat or cold.

*Other Factors.*—In both the sensory and the imaginal series H and W frequently reported the kinaesthesia of eye-movement, accompanied or followed by visual imagery. The report was less common with B and Br.

Auditory-motor (verbal) processes played an important part in H's reports. They often appeared at the beginning of his train of imagery, and carried a generalised reference to the previous experience. In the temperature series they might further carry the particular meaning of cold or warmth, and thus render it doubtful whether an imaginal temperature was experienced. They also carried the meaning of confirmation, acceptance or denial of the adequacy of a given process-complex as realisation of the former experience.

B relied largely upon auditory-motor processes; they might so fully mean the past experience that no other processes of any kind were reportable. In Series II B introduced auditory-motor images into the situations, in order by their aid to make his task easier. He reports more adequate realisations in this Series than in Series I, though his cutaneous imagery does not become more assured.

The other *O's* have little to say of auditory-motor processes.

*The Methods.*—The method of Series I is a variant of that recommended by J. R. Angell.<sup>4</sup> Preliminary work with blunt points had led to very confused and unsatisfactory results; we therefore enlarged the area of stimulation, in order to give form and substance to the perception and a better foothold to the image. The method of Series II was suggested by the work of A. H. Sullivan on kinaesthetic imagery.<sup>5</sup> We have no doubt, in view of the competence of our four principal *O's*, that either method would have detected the presence of free cutaneous imagery. None of these *O's*, in fact, complained of the methods; recall and realisation were feasible enough; the difficulty lay in making sure of the image. Advance thus seems to depend rather on a sharpening of *O's Einstellung* than on improvement of technique.

#### CONCLUSIONS

A conservative reading of our results leads to the following conclusion. Where *O's* imaginal type tends to be one-sided (B, W), the imagery ordinarily employed comes up so readily and so dominantly that any possible traces of cutaneous imagery are obliterated; the *O's* report substitutive imagery only. Where the type is generalised (Br, H), cutaneous imagery of pressure, warmth and cold occurs rarely in subordination to free imagery of vision or kinaesthesia.

This is the conclusion that Br and H themselves incline to accept. Both *O's* doubt the occurrence of cutaneous imagery in the situations of everyday life; both are disposed to think that under the conditions of the experiment they sometimes obtained it.

There is, however, no proof of this position; and there is full proof of the trap set by meaning for the untrained or momentarily unwary observer.

<sup>4</sup> Report of the Committee of the American Psychological Association on the Standardising of Procedure in Experimental Tests, 1910, 94 f.

<sup>5</sup> This JOURNAL, xxxii., 1921, 54 ff.